

12

**EUROPEAN PATENT APPLICATION**

21 Application number: 81103158.2

59 Int. Cl.<sup>3</sup>: **G 10 H 1/38, G 10 H 7/00**

22 Date of filing: 28.04.81

30 Priority: 30.04.80 JP 57376/80

71 Applicant: **Matsushita Electric Industrial Co., Ltd., 1006, Oaza Kadoma, Kadoma-shi Osaka-fu, 571 (JP)**

43 Date of publication of application: 11.11.81  
Bulletin 81/45

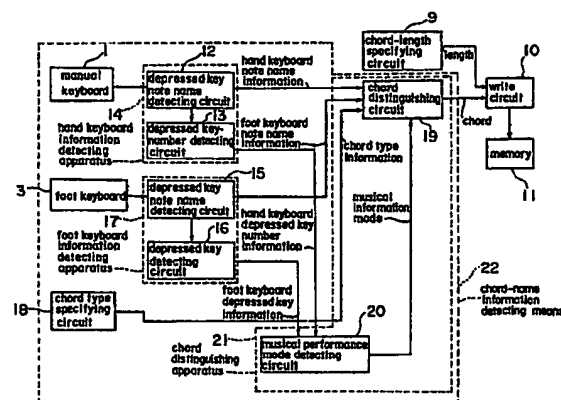
72 Inventor: **Okuma, Yoshikazu, 4023-2, Oaza Hoshida, Katano-shi Osaka-fu (JP)**  
 Inventor: **Ogura, Takeshi, 6-8-19, Minamileganosho, Habikino-shi Osaka-fu (JP)**  
 Inventor: **Tamura, Kimimaro, Shokei-Ryo, 7-4, Korigaoka, Hirakata-shi Osaka-fu (JP)**

84 Designated Contracting States: **DE FR GB IT NL**

74 Representative: **Eisenführ & Spelser, Martinstrasse 24, D-2800 Bremen 1 (DE)**

54 **Electronic musical instrument.**

57 An electronic musical instrument wherein a function for automatically detecting the musical performance mode is provided by the condition of a hand keyboard, a foot keyboard, a chord type specifying circuit for one finger use, etc. to simplify the operation for causing the chord to be stored.



**EP 0 039 464 A2**

**BEST AVAILABLE COPY**

IAP6 Rec'd PCT/PTO 25 SEP 2006

ELECTRONIC MUSICAL INSTRUMENT

The present invention relates to an electronic musical instrument and, more particularly, a chord storing apparatus to be employed in the instrument which is able to simplify an operation of causing a chord to be stored.

According to the chord storing apparatus of the conventional electronic musical instrument, to cause the chord to be stored, a record button was depressed to put a chord storing apparatus into a record condition, a method of determining a chord was selected by a musical performance mode specifying button, a chord was determined through depression of the keyboard or the like in accordance with the musical performance mode, and the inputting operation of the chord length specification for determining the length of the chord was required to be performed. The musical performance mode specification button means a button for determining a musical performance mode such as an one finger mode, which is a musical performing method of determining a chord through depression of one key of the keyboard, a finger mode, which is a musical performing method of determining a chord through depression of a plurality of hand keyboards

in accordance with the composing sound of the chord or a separated pedal mode, which is a performing method for determining the chord through selection of the bass sound of the chord, by a pedal keyboard or foot keyboard, through the depression  
5 of the composing sound of the chord by a manual keyboard or hand keyboard (hereinafter they are referred to as one finger mode, finger mode, separated pedal mode, and are called musical performance mode in a general term).

Referring to Fig. 1, a manual keyboard or hand keyboard  
10 1 is connected to a circuit 2 for detecting depressed key note names. A note name corresponding to the keyboard depressed by the hand keyboard 1 is depressed so that hand keyboard note name information can be provided. A pedal keyboard or foot keyboard 3 is connected to a circuit 4 for detecting depressed  
15 note names. A note names corresponding to the keyboard depressed by the foot keyboard 3 is detected so that foot keyboard note name information can be provided. A circuit 5 for specifying a finger chord type specifies the information of chord types (major, minor, seventh, etc.) in the one  
20 finger mode, whereby the chord type information for one finger use is provided. A circuit 6 for specifying musical performance specifies the performance mode in accordance with the musical performance mode of the one finger, finger or the like selected by the performer. A circuit  
25 7 for distinguishing chords distinguishes chords, to which the musical performance mode information, the hand

keyboard note name information, the foot keyboard note  
name information, the chord type information for one finger  
are inputted, distinguishes chords depressed by the hand  
keyboard note name information, the foot keyboard note  
5 name information and the chord type information for one  
finger use in accordance with the performance mode thereby  
to detect the information (C major, E minor, etc.) of the  
chords. A chord information detecting apparatus 8, which  
is composed of the hand keyboard 1, the depressed key  
10 note name detecting circuit 2, the foot keyboard 3, the  
depressed key note name detecting circuit 4 and the chord  
type specifying circuit 5 for one finger use as described  
hereinabove, detects the chord information of the keyboard  
depressed in accordance with the musical performance mode.  
15 A chord length specifying circuit 9 outputs the  
information of the length to be continued (one bar,  
half a bar, etc.) of the chord information and length  
information are stored in a memory 11 by a write circuit  
10.

20           However, under such conventional construction  
as described hereinabove, the chord detecting apparatus 8  
had no functions for automatically detecting the musical  
performance mode. To store the chord, the musical-  
performance-mode specifying circuit 6 had to be operated  
25 to specify the musical performance mode, thus resulting  
in extremely difficult operation.

An object of the present invention is to provide an electronic musical instrument of such characters which can eliminate the disadvantages inherent to the conventional as described hereinabove, and in which the musical performance mode is not required to be specified in the chord storing operation so that the operation can be simplified and the operational errors can be reduced.

Another object of the present invention is to provide an electronic musical instrument wherein a function for automatically detecting the musical performance mode is provided by the condition of the hand keyboard, the foot keyboard, the chord type specifying circuit for one finger use, etc. to simplify the operation causing the chord to be stored.

According to the present invention, there provides an electronic musical instrument comprising a keyboard apparatus for players to perform the melody or accompaniment of a music, a keyboard information detecting means for detecting information on the key depressed by said keyboard apparatus, a musical performance mode detecting means for automatically detecting a performing method of determining a chord according to the output from said keyboard information detecting means, and a chord distinguishing means for distinguishing the chord in accordance with the output from said keyboard information detecting means and the output from said performing mode

detecting means, thereby to simplify the operation for causing the chord to be stored.

These and other objects, features, aspects, and advantages of the present invention will become more  
5 apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a block diagram of a conventional example as referred above;

10 Fig. 2 is a block diagram of an electronic musical instrument, in one embodiment of the present invention;

Fig. 3 is a sequence flow chart of a hand keyboard information detecting circuit of Fig. 2;

15 Fig. 4 is a sequence flow chart of a musical performance mode detecting circuit of Fig. 2;

Fig. 5 is a sequence flow chart of a chord distinguishing circuit of Fig. 2;

20 Fig. 6 is a sequence flow chart for distinguishing the chords of Fig. 2;

Fig. 7 is a block diagram of an electronic musical instrument in another embodiment of the present invention;

25 Fig. 8 is a block diagram showing one example of a chord type specifying circuit of Fig. 7; and

Fig. 9 is a sequence flow chart of the chord type specifying circuit of Fig. 7.

Before the description of the present invention proceeds, it is to be noted that like parts are designated by like reference numerals throughout the accompanying drawings.

5                   Referring to Fig. 2, a hand keyboard 1 is connected to a hand keyboard information detecting apparatus 14 composed of a depressed key note name detecting circuit 12 and a depressed-key-number detecting circuit 13 so that the depressed key note name and the depressed-key-number of a key  
10                   depressed by the hand keyboard 1 are automatically detected.

                  Fig. 3 shows the sequence of the hand keyboard information detecting apparatus 14. The hand keyboard information detecting apparatus 14 is provided with four note-name information registers and one depressed-key-  
15                   number register, these registers being shown in Fig. 3. The sequence of these registers will be described herein- after with reference of Fig. 3. The note name information register and the depressed-key-number register are initially cleared and then the scanning operation of the hand keyboard  
20                   1 starts. When the depressed key exists through the scanning operation of the hand keyboard 1, note-name information corresponding to a key depressed by the hand keyboard is sequentially stored in the note name information register. Simultaneously the number of the  
25                   depressed keys is counted and the counted results are accumulated in the depressed-key-number register.

When the number of the depressed keys accumulated by the depressed-key-number register becomes four notes or more, the scanning operation stops to complete the sequence.

When the number of the depressed keys is four or less in  
5 note or no depressed keys exist, a distinguishing operation is effected as to whether or not all the hand keyboards 1 have been scanned. When the scanning operation is not completed, the sequence returns to the sequence of the keyboard scanning operation. When the scanning operation  
10 is completed, the sequence is completed. The hand keyboard information detecting apparatus 14 stores the note name information of the depressed key and the depressed-key-number of the hand keyboard 1 are stored in the respective registers through the sequence operation in accordance  
15 with Fig. 3.

Referring to Fig. 2, a foot keyboard 3, which is composed of a depressed key note name detecting circuit 15 and a depressed key detecting circuit 16, is connected to a foot keyboard information detecting apparatus 17 to  
20 detect the note name information of a key depressed by the foot keyboard 3 and the existence of the depressed key. In the case of the foot keyboard, the note name information, which is one note, will do. As a result, the number of the depressed keys is not required to be detected. All  
25 that is required to be done is to detect whether or not the depressed key exists. The sequence of the foot



keyboard information detecting apparatus 17 is not required to be fully described, since the sequence is similar to the sequence (see Fig. 3) of the hand keyboard information detecting apparatus 14.

5                   A musical performance mode detecting circuit 20 of Fig. 2 automatically detects the musical performance mode by a hand keyboard depressed-key-number information to be provided by a depressed-key-number detecting circuit 13 and a foot keyboard depressed key information  
10                   to be provided by a depressed-key detecting circuit 16. The sequence of a musical performance mode detecting circuit 20 will be described hereinafter with reference of Fig. 4. First, if the foot keyboard depressed-key information is distinguished and the foot keyboard is  
15                   kept depressed, the musical performance mode becomes a separated pedal. When the foot keyboard is not depressed, the hand keyboard depressed-by-number information is distinguished. When the depressed key of the hand  
20                   keyboard is one, the mode becomes an one finger mode. When the depressed key of the hand keyboard comes to 2 or more, the mode becomes a fingered mode. Each of these modes is stored in the musical performance mode register shown in Fig. 4.

                  Referring to Fig. 2, a chord type specifying  
25                   circuit 18 specifies the type (minor, seventh, etc.) of the chords to output the chord type specifying information,

which is composed of specification existence information and chord type information in the existence of the specification.

Referring to Fig. 2, a chord distinguishing circuit 19 distinguishes the chords (C major, E minor, etc.), in accordance with a musical performance mode detected by a musical performance mode detecting circuit 20, by a hand keyboard note name information to be provided from a depressed-key-note-name detecting circuit 12, a foot keyboard note name information to be provided from the depressed-key-note-name detecting circuit 15 and a chord type specified information to be specified by the chord type specifying circuit 18.

Fig. 5 and Fig. 6 show the sequence of the chord distinguishing circuit. As the chord information, the root (C, E, etc.) and type (major, minor, etc.) of the chord are provided. The sequence will be described in accordance with Fig. 5 and Fig. 6. A root register for storing the root of a chord distinguished as a register and a type register for storing the chord type are used, which are described in Fig. 5. Referring to Fig. 5, the root register and the type register are reset for the first time. The musical performance mode detected by the musical performance mode detecting circuit 20 is distinguished. In the case of one finger, the hand keyboard note name information is stored as the root and

the major is stored as the type. In the case of the finger mode and the separated pedal mode, the chord distinguishing operation which has such sequence as described in Fig. 6 is performed. In the finger mode and the separated pedal, the difference of the chord distinguishing operation therebetween is the hand keyboard note name information in the case of the finger mode, and the foot keyboard note name information and the hand keyboard note name information in the case of the separated pedal. However, the general idea is the same. As shown in Fig. 6, the note name information is sequentially distinguished as to which chord corresponding to the information. When the note name information has conformed to a chord, the type and root of the chord are stored. When the note name information has not conformed to any chord, one note from the note name information is selected as a root and is stored in the root register. The major is stored in the type register as the chord type information. In the root information and type information provided as described hereinabove, the type register is corrected to the type information of the chord type specifying circuit 18, only when the specifying operation exists, by the chord specification existence information of the chord type specifying circuit 18 of Fig. 2 as shown in Fig. 5.

The chord information (root and type) provided as described hereinabove by the chord distinguishing apparatus 21 of Fig. 2 and the length information of the chord length specifying circuit 9 are written in the  
5 memory 11 by a write circuit 10.

Fig. 7 shows an embodiment in the case of two types of one finger and the finger mode as the musical performance mode. The depressed key of the hand keyboard 1 is converted into the note name information by the  
10 depressed key note name detecting circuit 12. The chord distinguishing operation, which is equal to the sequence of Fig. 6, is performed by the chord distinguishing apparatus 21, which has the equal sequence to the finger mode of Fig. 5. The type register is corrected by the  
15 chord specification existence information of the chord type specifying circuit 22 of Fig. 7 and the chord type information to make the chord information (root and type). The length information of the chord of the chord length specifying circuit 9 and the chord are written in the  
20 memory 11 by the write circuit 10.

Referring to Fig. 8, the specification inputting apparatus of a chord type specifying circuit 22 in Fig. 7 is constructed by the use of a foot keyboard. Four chord types are provided through the on and off condition of the  
25 black key and the white key.

Fig. 9 shows a flow chart, which has the

operational sequence of Fig. 8 collected. According to the description of the sequence, the distinguishing operation is made to the minor seventh when the white key and the black key are both on by the depressed key condition of the foot keyboard, to the seventh when the white key only is on, and to the minor when the black key only is on, depending upon the condition of the depressed key of the foot keyboard. It is judged that the chord specification exists upon storing in the chord type register and no chord specification exists when the foot keyboard is not depressed. When no chord specification exists, the type of the chord becomes major in Fig. 7 so that four chord types of major, minor, seventh and minor seventh are provided.

15           The hand keyboard information detecting apparatus 14, the foot keyboard information detecting apparatus 17, the chord distinguishing apparatus 21, etc. of Fig. 2 are composed of microprocessors. The sequence shown in Fig. 3, Fig. 4, Fig. 5 and Fig. 6 may be carried out in accordance with a program. The same thing can be said even about the embodiment of Fig. 7 through Fig. 9.

          According to the present invention as described hereinabove, the musical performance mode is not required to be specified in the chord storing operation so that the operation can be simplified and the operational errors can be reduced.

Although the present invention has been described  
and illustrated in detail, it is to be clearly understood  
that the same is by way of illustration and example only  
and is not to be taken by way of limitation, the spirit  
5 and scope of the present invention being limited only by  
the terms of the appended claims.

What is claimed is:

1     1.           An electronic musical instrument comprising a  
2     keyboard apparatus for players to perform the melody or  
3     accompaniment of a music, a keyboard information detecting  
4     means for detecting information on the key depressed by  
5     said keyboard apparatus, a musical performance mode  
6     detecting means for automatically detecting a performing  
7     method of determining a chord according to the output  
8     from said keyboard information detecting means, and a  
9     chord distinguishing means for distinguishing the chord  
10    in accordance with the output from said keyboard information  
11    detecting means and the output from said performing mode  
12    detecting means.

1     2.           An electronic musical instrument in accordance  
2     with Claim 1, wherein the keyboard information detecting  
3     means is composed of a hand keyboard information means  
4     for detecting the depressed key information of a hand  
5     keyboard.

1     3.           An electronic musical instrument in accordance  
2     with Claim 1, wherein the keyboard information detecting  
3     means is composed of a hand keyboard information means  
4     for detecting the depressed key information of the hand  
5     keyboard and a foot keyboard information detecting  
6     means for detecting the depressed key information of the  
7     foot keyboard.

1     4.           An electronic musical instrument in accordance

2 with Claim 2 or Claim 3, wherein the hand keyboard  
3 information detecting means is composed of a depressed-  
4 key note-name detecting means for detecting the note name  
5 of a key depressed by the hand keyboard and a detecting means for  
6 detecting the number of the depressed keys for detecting  
7 the number of the depressed keys.

1 5. An electronic musical instrument in accordance  
2 with Claim 3, wherein a foot keyboard information detecting  
3 apparatus is composed of a depressed-key note-name  
4 detecting means for detecting the note name of a key  
5 depressed by a foot keyboard and a depressed-key detecting  
6 means for detecting whether or not the foot keyboard is  
7 depressed.

1 6. An electronic musical instrument comprising a  
2 keyboard apparatus for players to perform the melody or  
3 accompaniment of a music, a keyboard information detecting  
4 means for detecting information on the depressed key of  
5 said keyboard apparatus, a musical performance mode  
6 detecting means for automatically detecting a performing  
7 method of determining a chord according to the output  
8 from said keyboard information detecting means, a chord  
9 type specifying means for specifying the type of chords  
10 of major, minor, seventh, etc., and a chord distinguishing  
11 means for distinguishing a chord according to the output  
12 from said keyboard information detecting means, the  
13 output from said musical performance mode detecting means



14 and the output from said chord type specifying means.

1 7. An electronic musical instrument in accordance  
2 with Claim 6, wherein a chord type specifying means is  
3 composed of a foot keyboard, a black-key on detecting  
4 means for detecting the depression of the black key of  
5 said foot keyboard, a white-key on detecting means for  
6 detecting the depression of the white key of said foot  
7 keyboard and a chord type specifying means for specifying  
8 the chord type by the detection output of said black-key  
9 on detecting means and said white-key on detecting means.

1 8. An electronic musical instrument comprising  
2 a keyboard apparatus for players to perform the melody or  
3 accompaniment of a music, a keyboard information detecting  
4 means for detecting information on the depressed key of  
5 said keyboard apparatus, a musical performance mode  
6 detecting means for automatically detecting a performing  
7 method of determining a chord according to the output  
8 from said key board information detecting means, a chord  
9 distinguishing means for distinguishing the chord in  
10 accordance with the output from said keyboard information  
11 detecting means and the output from said performing mode  
12 detecting means, a chord length specifying means for  
13 specifying the length of the chord, a write means for  
14 causing the information of the output of said chord  
15 distinguishing means and of the output of the chord length  
16 specifying means to be stored, and a chord storing means

for causing the output of said memory means to store the distinguished chord and the chord length.

Fig. 1

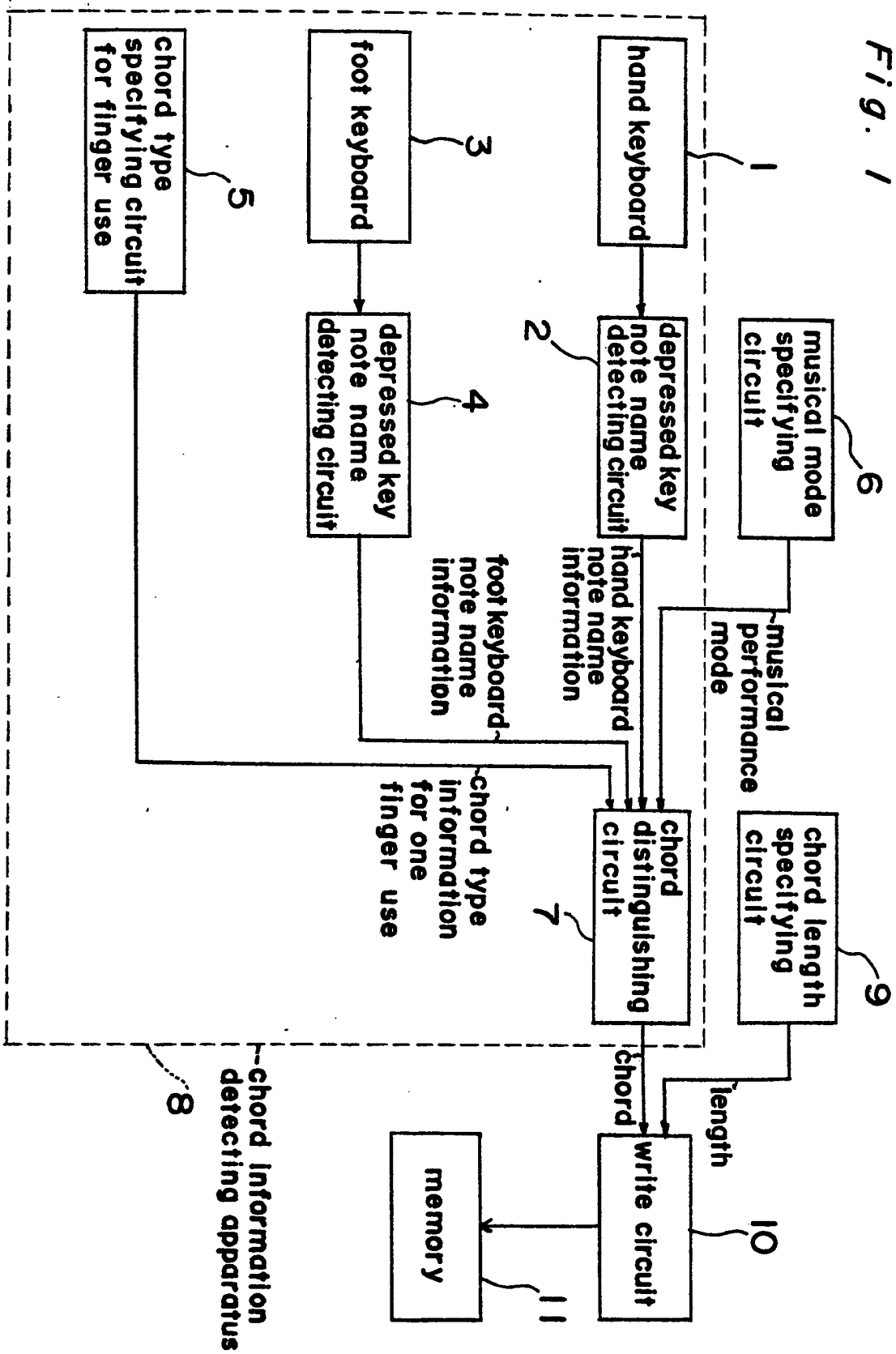
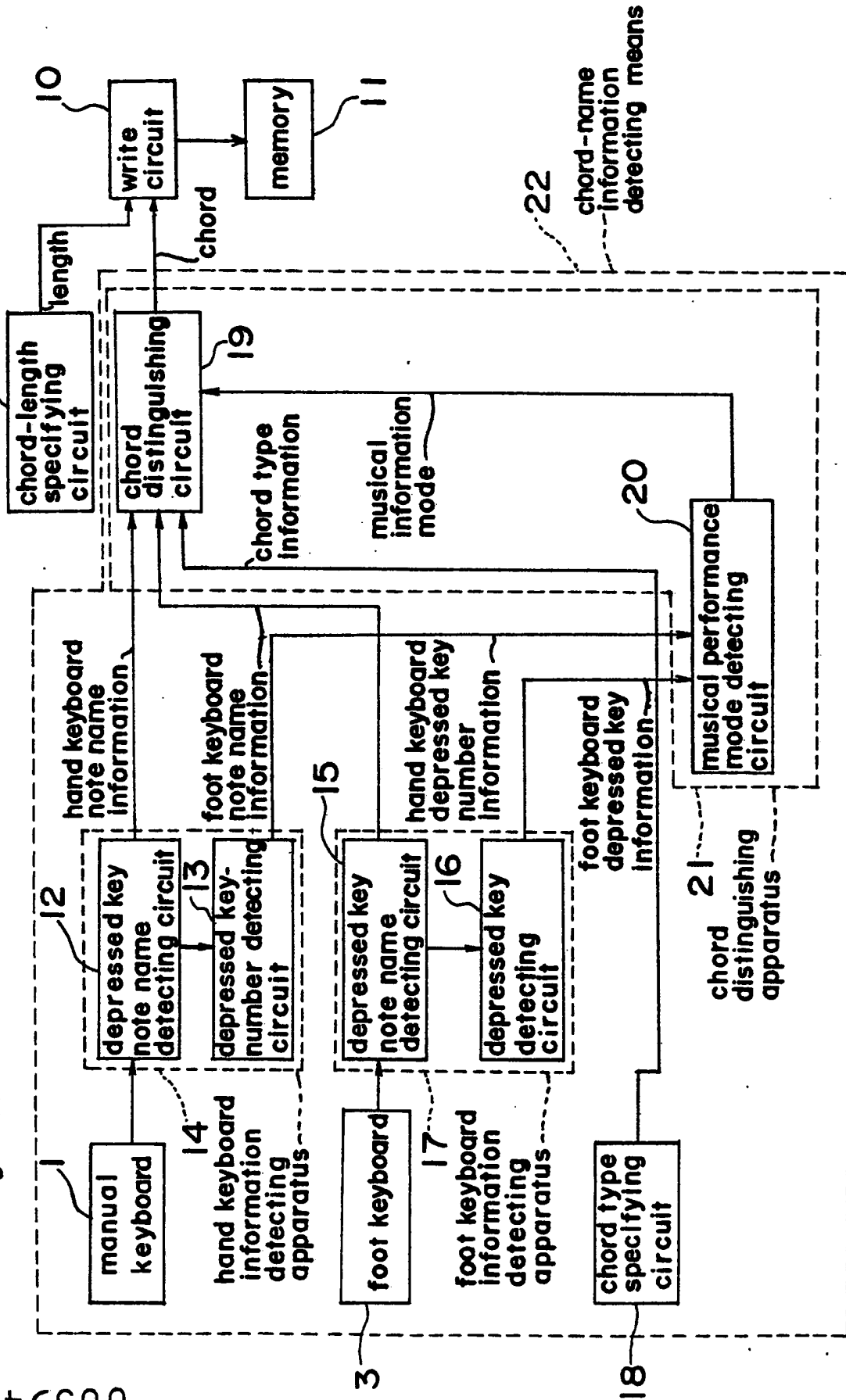


Fig. 2



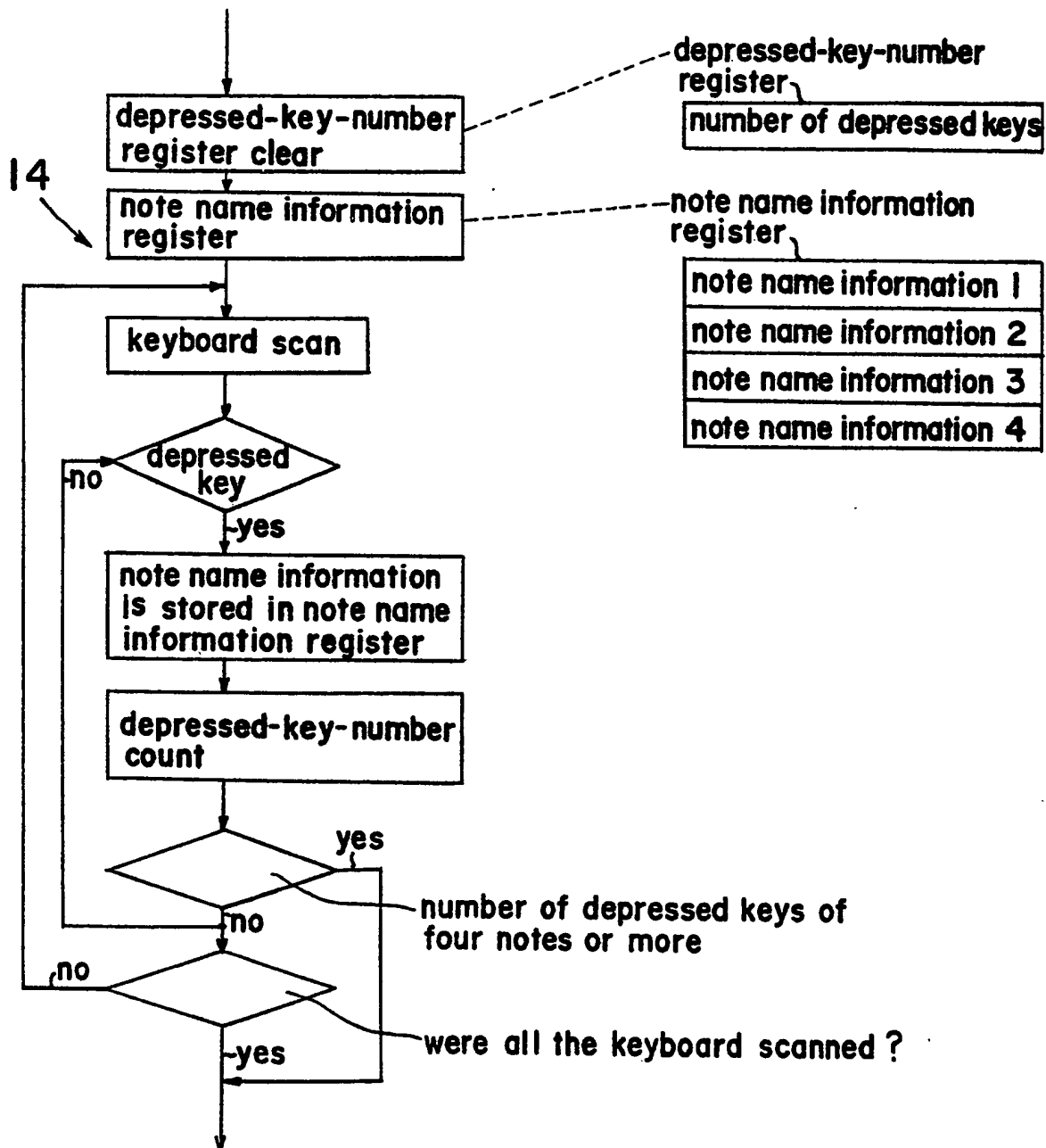


Fig. 3

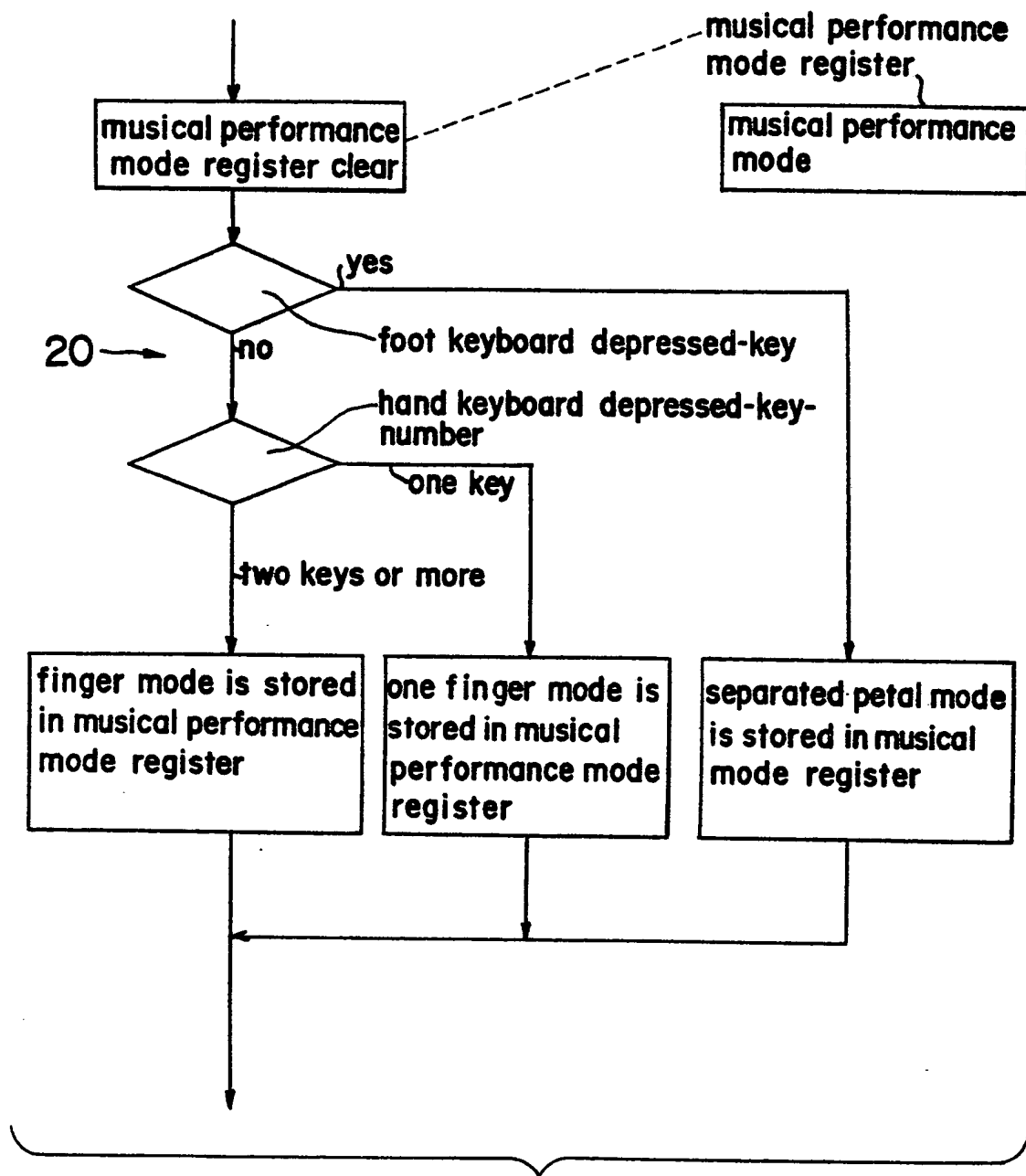


Fig. 4



Fig. 6

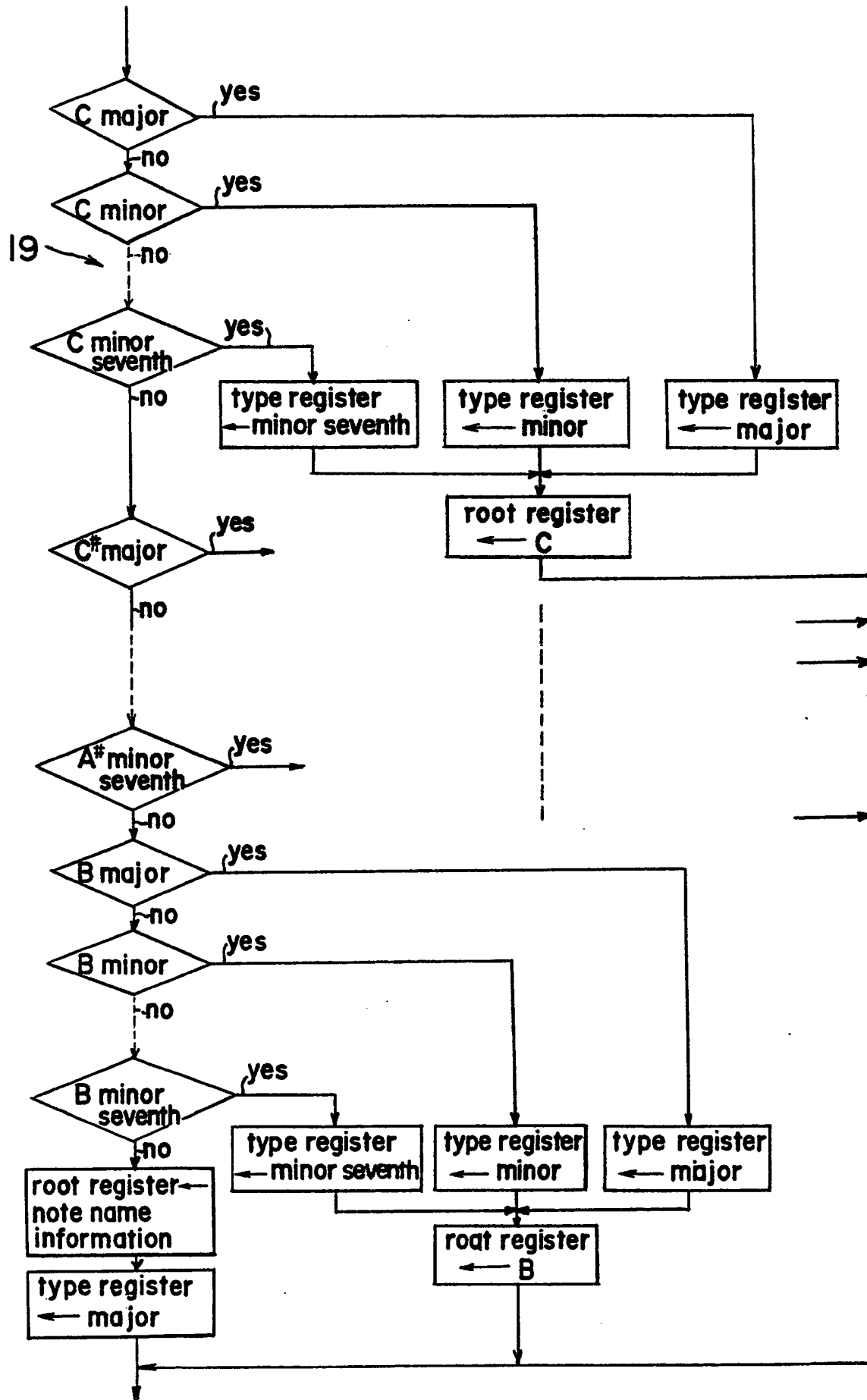




Fig. 7

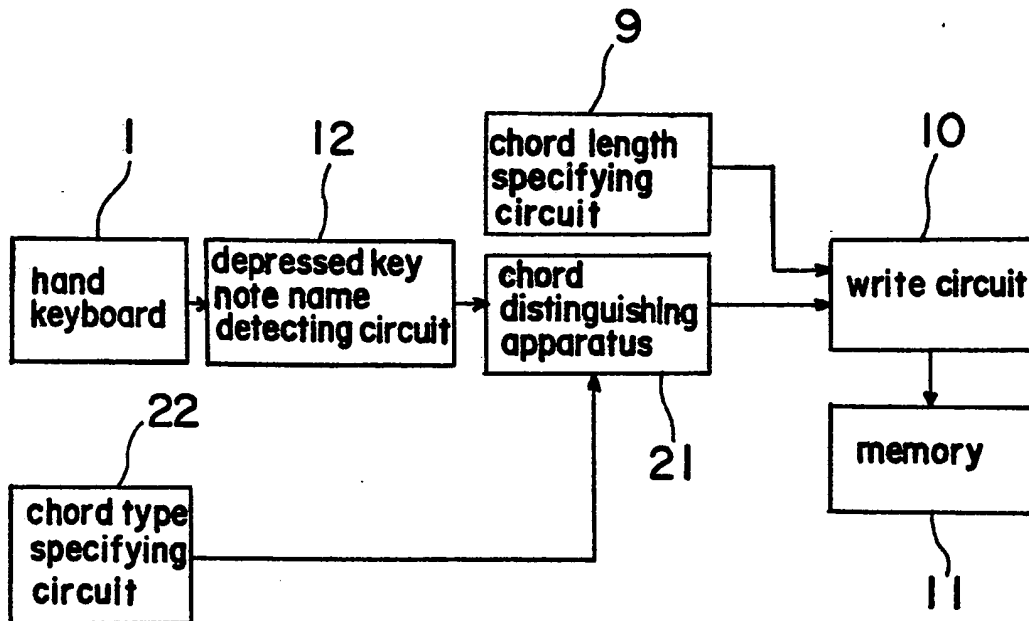
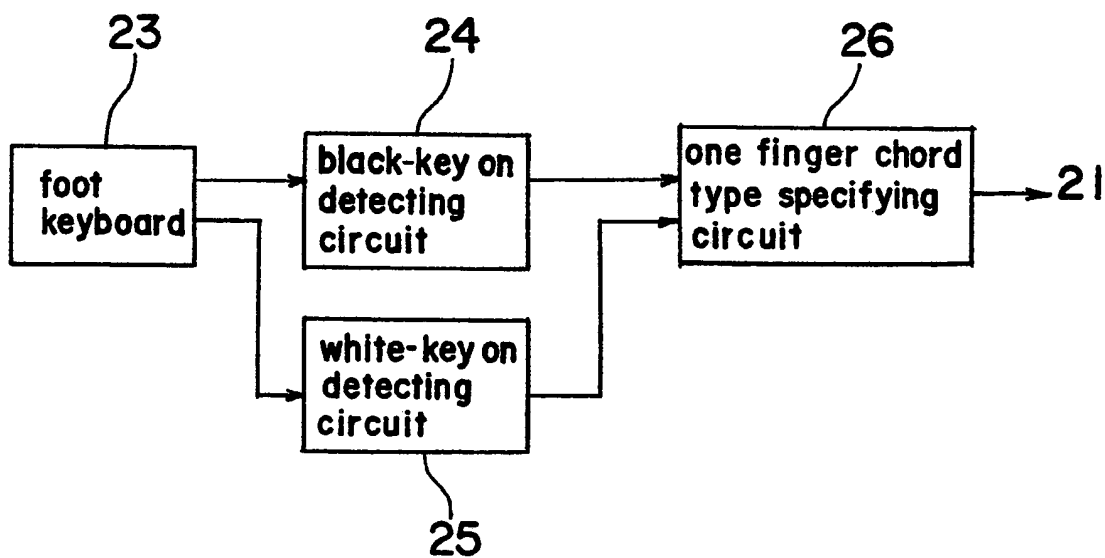


Fig. 8



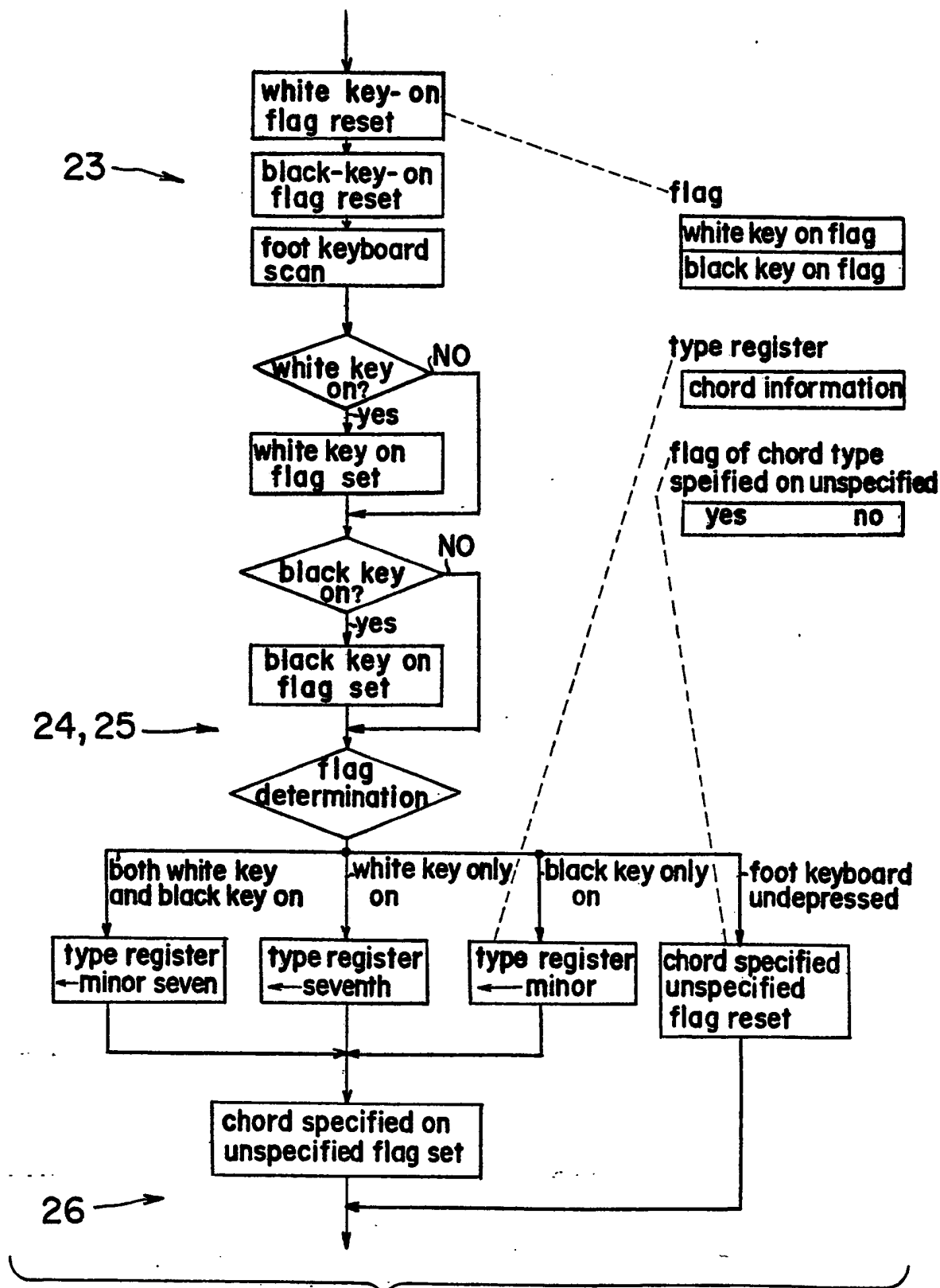


Fig. 9